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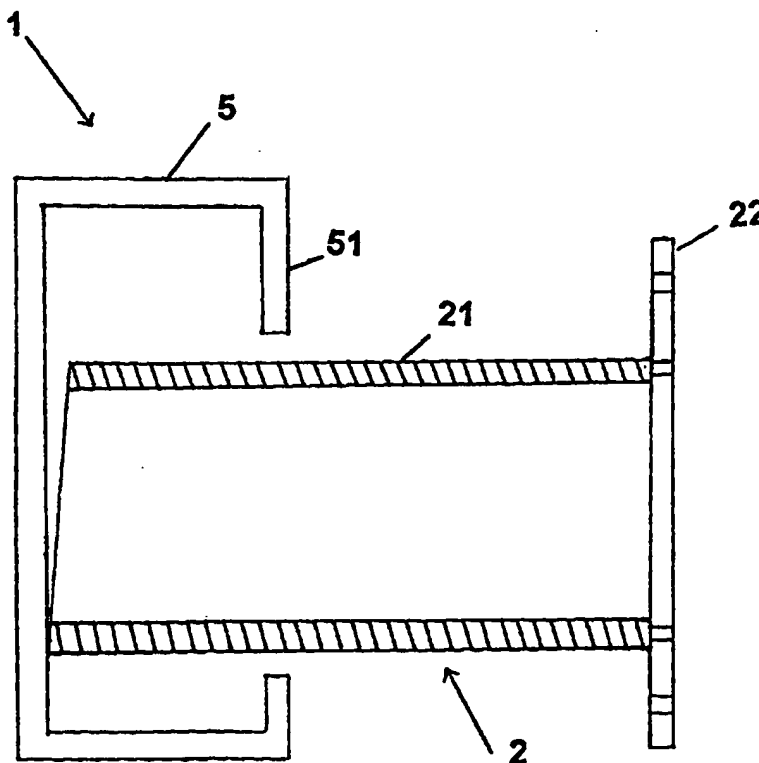
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(54) Title: VEHICLE BUMPER ASSEMBLY

(57) Abstract

Energy absorbing vehicle bumper assembly (1) comprising a pair of longitudinally extending crush cans (2) inserted between a front body structure and a bumper armature (5). The crush cans (2) are composed of a crush tube member (21) and an accommodating carrier member (22) where the crush tube member extends into a cavity of the bumper armature (5).



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## Vehicle bumper assembly

The present invention relates to a vehicle bumper assembly and more particularly to a simplified bumper mounting assembly improving the energy absorbing characteristics of the assembly.

Several front body structures of a vehicle provided with so-called crush boxes have recently been disclosed. Such crush boxes are disposed in front of a front-side member of a vehicle body structure (frame) so as to absorb an impact load of certain predetermined value, thereby eliminating deformation of the front-member itself.

Thus, EP 0 546 352 A1 discloses a rather complicated design of such crush box/can comprising several sections composed of plate material having different thickness and different cross-sectional areas in order to exhibit a total plastic characteristic in two stages. This particular crush box structure is designed for co-operation with acceleration sensors for an optimal performance of airbag protection and is too laborious and consequently rather expensive for manufacturing and assembling purposes.

It is therefore an object of the present invention to provide a new, simple design of a crush box allowing for low manufacturing and assembling costs.

Another object of the invention is to provide a light weight bumper assembly ensuring improved weight/energy absorbing ratio.

Still another object of the invention is to provide a connection between the bumper and the crush box (can) reducing peak-load under impact.

These and other objects and features of the present invention are met by provision of a crush can member as it appears from the accompanying patent claim 1, the attached drawings and the following description under reference to Figures 1-3, where

Fig. 1 illustrates schematically in a vertical cross-sectional view a vehicle bumper assembly comprising a novel concept of crush can configuration according to the present invention,

Fig. 2 shows in a horizontal cross-sectional view a particular embodiment of a crush tube member and an accommodating carrier member constituting the crush can, and

Fig. 3 is a cross-sectional view of a crush tube member usable in the bumper assembly.

Referring to the drawings, and particularly to Fig. 1, the energy absorbing vehicle bumper assembly 1 comprises a bumper armature 5 defining a bumper cavity 51 and two components crush can 2 consisting of a crush tube member 21 and an accommodating carrier member 22 illustrated as a simple fastening bracket attached to a front vehicle body structure (not shown in the Figure). The crush tube member representing here the energy absorbing member of the crush can assembly extends longitudinally into the bumper armature cavity 51. As a

preferred embodiment of the assembly, due to an angled cut on the tube member 21, the actual contact between the tube member and the bumper armature is reduced to a spot contact. This special configuration of the crush tube member and its arrangement/location in the bumper cavity 51 ensures an extended crush length (path), and the angled cut (up to  $10^\circ$ ) reduces significantly the start peak load imposed on the front body structure during a vehicle collision without adversely reflecting the total energy absorption of the assembly.

Fig. 2 shows in a horizontal cross-section a preferred embodiment of the crush can offering further advantages of this particular configuration of the assembly. The accommodating carrier member 22 is provided as an extruded box shape exhibiting co-extruded inwardly protruding fixation members 23 ensuring an adequate press fit joint between the inserted crush tube member 21 and the carrier member 22. Furthermore, due to a direct attachment of the accommodating carrier member to the bumper armature 5 by means of laterally extending flanges 24,25 will also the carrier member in the case of a vehicle collision directly participate in impact energy absorption. The particular embodiment of the carrier member 22 also allows for a flexible mounting of the crush tubes to the bumper with regard to a mutual angle between the members. The illustrated connection angle up to  $15^\circ$  improves the bumper assembly's performance in case of angled barrier impacts (deviation from a direct frontal collision). The possibility of reducing the start peak load by cutting/removing material is indicated by the dotted line defining a spot contact only between the bumper armature 5 and the crush tube 21.

Fig. 3 illustrates in a cross-sectional view a hexagonal configuration of an extruded crush tubular member 21 provided with longitudinally extending slits 26 allowing for a simple mechanical joining fixation of the crush tub 21 into the accommodating carrier member by means of screws, bolts etc. as indicated schematically in Fig. 1.

The hexagonal configuration of the crush member improves the energy absorbing characteristic of the assembly compared to a rectangular crush member. Other cross-sectional configurations of the crush member could be applied, and use of a multichamber extruded shape will further increase the energy absorption performance of the assembly.

Both components of the crush can assembly are advantageously provided as extruded shapes of aluminium alloy. This optimal combination of manufacturing technique, novel design and Al material used, apart from considerable simplification of the manufacturing and assembling, also increases the energy absorption related to the actual weight of the crush can approximately two times compared to application of steel material.

Claims

1. Energy absorbing vehicle bumper assembly (1) comprising a pair of longitudinally extending crush cans (2) inserted between a front body structure and a bumper armature (5),  
characterized in that  
the crush cans (2) comprise a crush tube member (21) and an accommodating carrier member (22) attached to the front body structure and where the crush tube member extends longitudinally into a cavity /interior of the bumper armature (5).
2. Assembly according to claim 1,  
characterized in that  
a contact between the crush tubes (21) and the bumper armature (5) is reduced to a spot contact by an angled cut of the crush tubes.
3. Assembly according to claim 1 or 2,  
characterized in that  
the accommodating carrier member (22) is extruded as a box shape provided internally with at least a pair of inwardly protruding fixation members (23) ensuring a press fit attachment of the crush tube member (21).
4. Assembly according to claim 1 or 2,  
characterized in that  
the crush tube (21) is a closed shape provided with longitudinally extending slits (51) for screw attachment to the mounting carrier member (22).

5. Assembly according to one or more preceding claims,  
characterized in that the crush tubes (21) are provided as  
extruded multichamber shapes.



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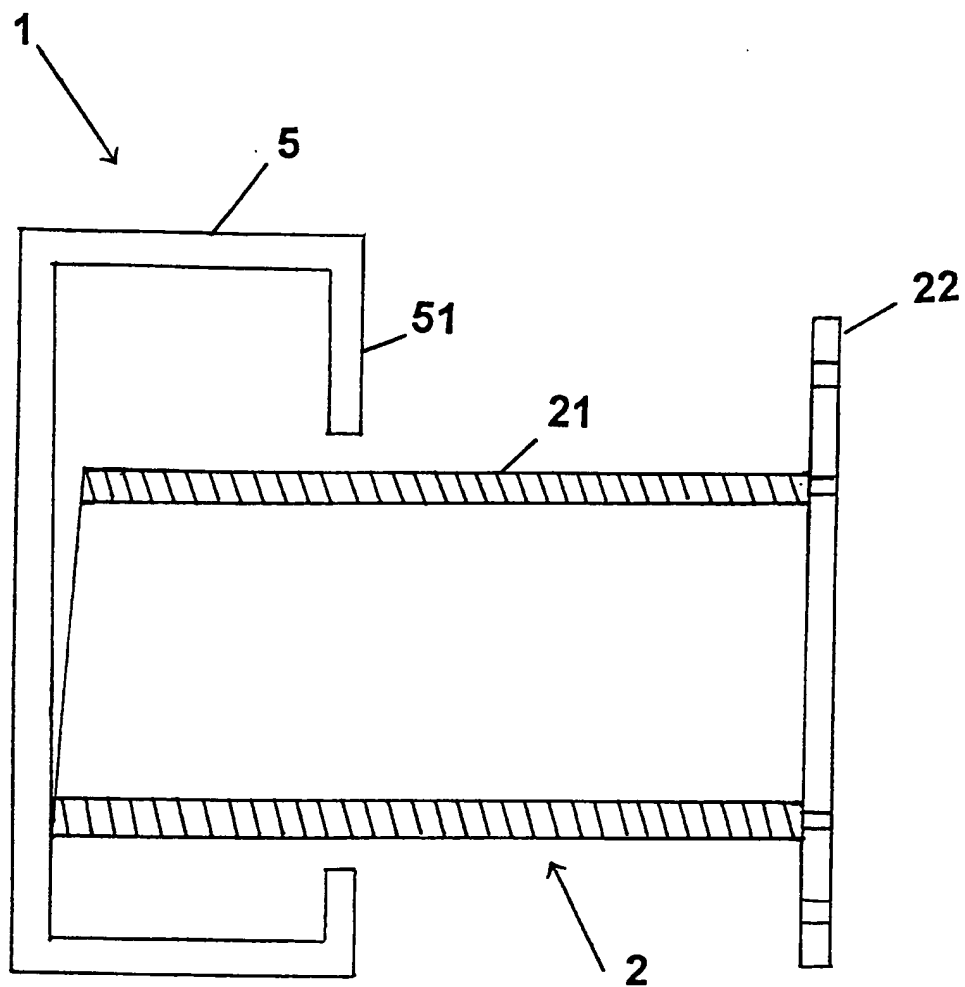


Fig. 1

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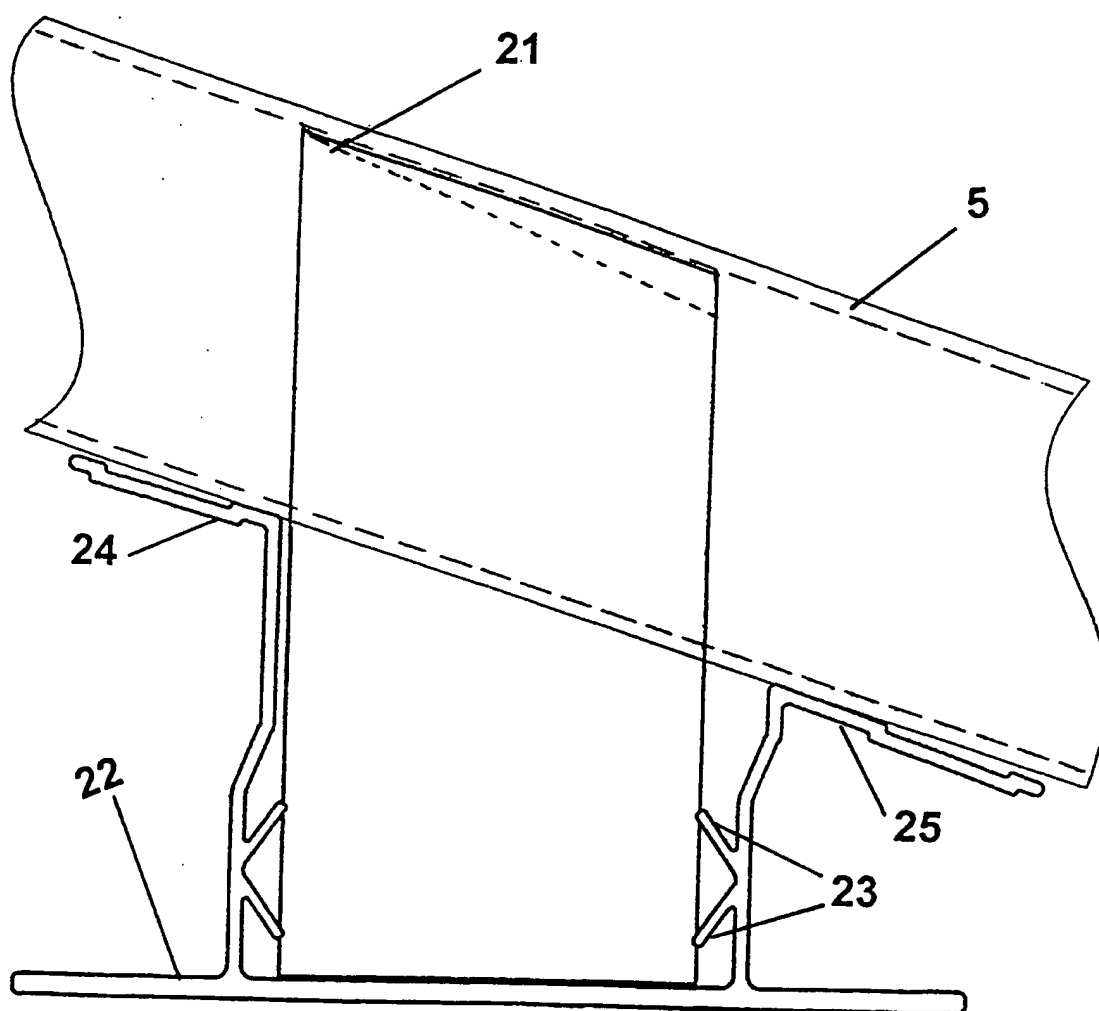


Fig. 2

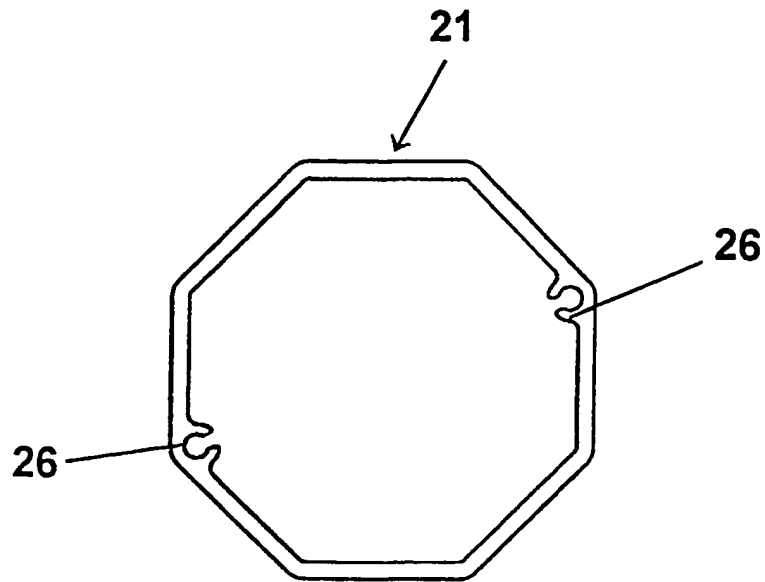


Fig. 3

**A. CLASSIFICATION OF SUBJECT MATTER**

IPC6: B60R 19/34

According to International Patent Classification (IPC) or to both national classification and IPC

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

IPC6: B60R

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

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Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

| Category* | Citation of document, with indication, where appropriate, of the relevant passages                       | Relevant to claim No. |
|-----------|--|-----------------------|
| X         | EP 0546352 A1 (TOYOTA JIDOSHA KABUSHIKI KAISHA),<br>16 June 1993 (16.06.93), abstract<br><br>--          | 1                     |
| X         | DE 2509351 C2 (THE BUDD CO.), 5 Sept 1985<br>(05.09.85), column 2, line 53 - column 4, line 48<br><br>-- | 1                     |
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| A         | DE 3740402 C2 (AUDI AG), 6 Sept 1990 (06.09.90),<br>column 4, line 44 - line 49<br><br>-----             | 1,5                   |

☐ Further documents are listed in the continuation of Box C. ☒ See patent family annex.

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**INTERNATIONAL SEARCH REPORT**  
Information on patent family members

01/10/96

International Application No.

PCT/NO 96/00176

| Patent document<br>cited in search report | Publication<br>date | Patent family<br>member(s)   | Publication<br>date  |
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